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Dear Dr Phipps

Please find enclosed Cardiff University's response to the National Assembly for Wales's consultation on the impact that the Science for Wales Strategy and its Delivery Plan has had on science, technology, engineering and mathematics (STEM) skills in Wales.

The University welcomes the opportunity for discussion and engagement that the National Assembly for Wales has provided and supports the goal and commitments as set out in Science for Wales. We particularly welcome the commitment that has been made to strengthen university science and the underpinning theme of a collegiate approach from all of those engaged in science to work together to deliver a strong and sustainable science base.

Cardiff University is committed to the achievement of the Science for Wales Strategy and its Delivery Plan through three key areas:

- Investing in the next generation of scientists and engineers to work in Wales to build a stronger economy through advancing our science base;
- Working with schools and Colleges to enlighten our young people on careers in science and engineering and by demonstrating the critical nature it plays in our modern world throughout every aspect of society;
- Working with the higher education sector to address historic under-representation of females in Science.

As you will be aware we have supported the Science of Wales strategy since it was launched at the University in March 2012 by our then Vice-Chancellor Dr David Grant and Wales' Chief Scientific Officer, Professor John Harries. Cardiff University also made the first appointment under the scheme with Professor Yves Barde taking up the position of Sêr Cymru Research Chair in Neurobiology in June 2013 and Cardiff University's Professor Julie Williams CBE has been appointed Wales' new Chief Scientific Adviser. The University runs the Life Sciences Resource Network Wales on behalf of the Welsh Government, with our partners in the Universities of Aberystwyth, Bangor and Swansea. Therefore the response included to the consultation should be read with the understanding of our commitment to providing the highest quality of STEM teaching and research and to assisting the Welsh Government in the achievement of its Grand Challenge priority areas.

1. What impact has the Welsh Government's strategy *Science for Wales* and Delivery Plan had on science, technology, engineering and mathematics (STEM) skills in Wales?

It is currently too early to measure the impact of the Science for Wales Strategy, however, it is clear that progress is being made against the outlined actions and indicators included in the delivery plan. Having the Strategy and the delivery plan in place provides a clear focus for Science delivery in Wales; it creates an environment that enables higher education institutions to deliver this important agenda and provides opportunities for cross sector engagement. The responses to the questions below should therefore be read in the context of the University's support and commitment to the strategy whilst accepting that the impact of the strategy would not yet be evident.

The impact of the Science for Wales Strategy and Delivery Plan will have been, and will continue to be, influenced by the recent changes and challenges that higher education in Wales is facing. Specifically changes to governmental policy, new fee regimes, new funding mechanisms, increased competition for research funding. Consideration also needs to be given to the broader changes in the UK University sector, such as the expansion and planned removal of the cap on student numbers for English Universities. Public funding for Welsh Universities for STEM subjects other than Medicine and Dentistry has now ended and Medicine and Dentistry will see significant cuts to their funding from 2014/15. The other STEM subjects are expensive to teach and the loss of public funding may affect the training we are able to provide our students. This does not signal a commitment from Government to invest in high level STEM skills for the public good and undermines the foundations that the Science of Wales Strategy and delivery plan has been built upon.

2. What progress has been made in addressing the issues identified in the Enterprise and Learning Committee's 2011 inquiry into the STEM agenda, including:
 - 2.1. The adequacy of provision of STEM skills in schools, further education colleges, higher education and work-based learning (including apprenticeships);

Applications for STEM courses at Cardiff University remain strong. As one of the major recruiters of STEM undergraduates in Wales we are still concerned that the level of STEM skills of current school leavers could be improved. We spend time getting them 'up to speed' and make a concentrated effort to ensure that our graduates are appropriately skilled and qualified to enter the workplace.

In order to address this issue and to raise the profile of STEM skills more generally Cardiff University undertakes a range of interventions with schools and adults alike. These include a range of public lectures and events put on throughout the year, working with primary and secondary schools and colleges, engaging with the STEM Ambassador Scheme and the provision of a range of credit bearing adult education courses run by the School of Lifelong Learning. One of our central concerns remains that young people do not have sufficient understanding of STEM career opportunities and how the STEM subjects they learn in school relate to the world around them. Our work with schools and colleges aims to rectify this.

Cardiff University is among the top tier of Britain's research intensive universities and is a member of the Russell Group of Universities. STEM teaching and research at the University is focused within two of its three Colleges: the College of Biomedical and Life Sciences and the College of Physical Sciences and Engineering. Both the teaching and research undertaken by these Colleges is recognised as excellent across Wales, the UK and internationally.

2.2. Value for money from the additional funding to support and promote STEM skills and whether the current supply of STEM skills is meeting the needs of the Welsh labour market;

The funding that has been made available for Sêr Cymru has already had a positive impact on the Welsh sector through raising the profile of STEM delivery and achievements in Wales. It has already recruited world leading scientists and teams of researchers and PhD students.

There is a real need to continue to invest in STEM skills that are matched to the current and future needs of the Welsh labour market. In early April the Royal Academy of Engineering reported a shortage of engineering graduates. The body estimates Wales will need an extra 2,500 graduates by 2020 to keep up with those approaching retirement.

2.3. The supply of education professionals able to teach STEM subjects and the impact of Initial Teacher Training Grants and the Graduate Teacher Programme on recruiting STEM teachers and education professionals;

As noted in a following section we have developed a Welsh language module on Teaching Maths in Secondary Schools, which has not previously been available to students.

2.4. The effectiveness of education and business links between education institutions and STEM employers.

Cardiff University has a history of engaging with business and employers and in particular our College of Physical Sciences and Engineering links with STEM businesses and employers through our Business Gateway. The Business Gateway connects industry to state of the art facilities and world-leading knowledge and expertise that exist within the College. The Gateway promotes and facilitates knowledge exchange and collaborative industrial research and development with companies and other organisations within Wales, UK and internationally. There are many opportunities for industrial partners to become involved with the College and we are keen for businesses to contribute to the education and employability of our students, via:

- assisting with delivery and content of our courses
- supporting undergraduate and postgraduate projects
- sponsoring key research and educational facilities
- providing vacation and year-out placements.

A major new development underway at Cardiff University is the creation of an innovation system that will drive economic growth in Wales and will help put Wales at the forefront of a number of new areas. We will be developing new facilities that allow our scientists to work in key, close to-market areas like catalysis, medical instruments, energy and aircraft materials where they can work closely with their counterparts in the relevant industries to take lab ideas to the stage where they can become commercial products. We will also be creating innovation hubs where start-up companies can get affordable space, advice and support so that their companies can grow and become independent.

3. Whether any progress has been made on addressing negative perceptions and gender stereotypes of STEM and promoting good practice to encourage women to acquire STEM skills and to follow STEM related careers.

Addressing negative perceptions and gender stereotypes of STEM will need to be undertaken across a number of years in order to have noticeable impact. Cardiff University is committed to addressing the historic under-representation of women across the higher education sector at all levels of academic employment, and believes that the best way of undertaking this is through embedding equality and diversity into the University culture. The university has a structure that aims to tackle stereotyping and gender bias and provide ways to embed equality into everyday activities. It starts with the Vice Chancellor and the Deputy Vice-Chancellor leading on equality and diversity and implementing a strategic equality plan which includes mandatory equality and diversity training.

There are a number of good practice examples of how at Cardiff University encourages women to acquire STEM skills and to follow STEM related careers some of these are outlined below.

STEM skills

- Conferences, seminars and lectures that raise the profile of women in STEM subjects;
- Women's mentoring scheme and dedicated STEM Schools mentoring;
- Representative publicity materials providing a positive message for both men and women;
- Cardiff University Research Opportunities Programme whereby undergraduate students are given a paid opportunity to work for 8 weeks in a research group over a period of the summer.

STEM related careers

- Confidence building training for female academics as well as promotion workshops;
- Support for early career researchers such as training, career advice and mentoring;
- Woman professors' group and other female networking groups to allow academics to exchange ideas and learn from one another;
- Springboard Women's Development Programme, a 4 day course delivered over 3 months, aimed at women from all backgrounds and stages of their careers. This development

programme is aimed at meeting the needs of women who work in university administration;

- Participation in schemes focused on support for female scientists such as Athena SWAN and Project Juno.

4. What progress has been made on learning STEM skills through Welsh medium education and training?

Positive progress has been made on learning STEM skills through the medium of Welsh through the support and funding provided by the Coleg Cymraeg. For example the funding has allowed the recruitment of a full time, fully funded, Welsh medium Lecturer and we are now offering some modules through the medium of Welsh. The numbers of students studying elements of their Maths degree in Welsh has risen from 0 -15 within three years. Maths students are now also able to choose Welsh medium personal tutoring and tutorial groups on some modules in the first year and third year, with plans to develop more, including second year modules. The main module that is being developed through the medium of Welsh is a Module on Teaching Maths in Secondary Schools.

Progress is also being made in Biosciences as students are now able to study 40 credits per year on modules in Ecology, Zoology and Biology through the medium of Welsh. The Coleg Cymraeg Incentive Scholarship (£500 per year if you study 40 credits per year through the medium of Welsh) also helps raise the profile of the Welsh language modules that are available.

Yours sincerely



Professor Elizabeth Treasure
Acting Vice-Chancellor

